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ABSTRACT

Few individuals in the history of education have had greater impact on education policy and practice than Benjamin S. Bloom. During a career that spanned more than 5 decades, his research and writing guided the development of many educational programs and provided insights into the untapped potential of educators to have all students learn well. Bloom's contributions to education began during his years in the Office of the Board of Examiners at the University of Chicago, where he worked from 1940 to 1959. Much of his work at this time focused on the relationships among methods of instruction, educational outcomes, and measurement of those outcomes. This work led to his first book in 1950 and eventually to the work for which he is best known, the "Taxonomy of Educational Objectives, Handbook I: The Cognitive Domain." In 1959 Bloom spent a year at the Center for Advanced Study in Behavioral Sciences at Stanford University. This year marked a shift in high research and writing, as Bloom began to concentrate on problems in learning, rather than problems in testing, measurement, and evaluation. Bloom's most notable contribution to teaching and learning was his work in developing the theory and practice of mastery learning. Mastery learning was developed as a way for teachers to provide higher quality and more appropriate instruction for their students. Mastery learning depends on feedback, correctives, and enrichments, combined with another essential element of mastery learning, congruence among instructional components. Mastery learning is not an educational panacea, but careful attention to the essential elements of mastery learning will allow educators at all levels to make great strides toward the goal of all children learning excellently. (Contains 44 references.) (SLD)

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To explain a simple idea in a complex way takes little talent or insight. But to explain a complex idea simply and meaningfully requires true genius. Such is precisely the contribution and genius of Benjamin S. Bloom.

Few individuals in the history of education have had greater impact on education policy and practice than Benjamin S. Bloom. During a career that spanned over five decades, his research and writing guided the development of innumerable educational programs and provided powerful new insights into the untapped potential of educators to have all students learn well.

Bloom's contributions to education policy and practice began during his years in the Office of the Board of Examiners at the University of Chicago where he worked from 1940 until 1959, succeeding Ralph W. Tyler as University Examiner in 1953. Much of his work at this time focused on the relationship among methods of instruction, educational outcomes, and measurement of those outcomes (e.g., Bloom, 1944, 1947; Bloom & Allison, 1949, 1950). This work led to his first book entitled, *Problem-Solving Processes of College Students* (Bloom & Broder, 1950) and eventually to the book for which Bloom is perhaps best known, the *Taxonomy of Educational Objectives, Handbook I: The Cognitive Domain* (Bloom, Englehart, Furst, Hill, & Krathwohl, 1956).

In 1959 Bloom left his position as University Examiner to spend a year at the Center for Advanced Study in Behavioral Sciences at Stanford University. This year marked a significant

change in the direction of his research and writing. During his stay at the Center, Bloom began work on what was to become *Stability and Change in Human Characteristics* (Bloom, 1964). In his words: "The freedom from the usual schedule and duties, the opportunity to explore a problem as deeply as possible, and the encouragement of the staff and other Fellows did much to help me get started on the problem of stability and change. The major outline of [the book] was completed at the Center" (p. ix). Thus began Bloom's shift from problems in testing, measurement, and evaluation, to problems in learning (Bloom, 1966a & b, 1974a), human development (Bloom, 1966c, 1973, 1985) curriculum (Bloom, 1965, 1974b), instruction (Bloom, 1968, 1984), and educational research (Bloom, 1966d, 1980).

Arguably Bloom's most notable contribution to teaching and learning was his work in developing the theory and practice of mastery learning (Bloom, 1968). The theoretical premises of mastery learning were set forth in the Introduction to Human Characteristics and School Learning (Bloom, 1976):

> The central thesis of this book is that variations in learning and the level of learning of students are determined by the students' learning history and the quality of instruction they receive. Appropriate modifications related to the history of the learners and the quality of instruction can sharply reduce the variation of students and greatly increase their level of learning and their effectiveness in learning in terms of time and effort expended. Where conditions for learning in the home and school approach some ideal, we believe that individual differences in learning should approach a vanishing point (Bloom, 1976, p. 16).

Over the last three decades, few educational programs have been implemented as broadly or evaluated as thoroughly as those associated with mastery learning. Programs based on

mastery learning operate today at every level of education in nations throughout the world. Perhaps most importantly, evaluations consistently show that when compared to traditionally taught classes, students in mastery learning classes learn better, reach higher levels of achievement, and develop greater confidence in their ability to learn and in themselves as learners (Guskey & Pigott, 1988; Kulik, Kulik, & Bangert-Drowns, 1990a).

In the remaining portion of this paper I will describe how mastery learning originated and the essential elements involved in its implementation. I also will discuss the improvements in student learning that typically result from the use of mastery learning and how this strategy has provided practical solutions a variety of pressing instructional problems.

The History and Development of Mastery Learning

Throughout history, teachers have struggled with the problem of how to make instruction more appropriate for their students. By improving the quality and appropriateness of their instruction, many believed that virtually all of their students might be able to learn quite well. This optimistic perspective about teaching and learning can be found in the writings of early educators such as Comenius, Pestalozzi, and Herbart (Bloom, 1974). It is also the basic premise that underlies mastery learning.

Mastery learning was developed as a way for teachers to provide higher quality and more appropriate instruction for their students. Under these more favorable learning conditions, Bloom theorized that nearly all students would be able to learn quite well and truly "master" any subject. And, indeed, the tremendous improvement in student learning gained through modern classroom applications of mastery learning confirmed his theory. As a result, mastery learning has generated great interest and enthusiasm among educators throughout the world.

John B. Carroll's "Model for School Learning"

Although the roots of mastery learning can be traced to the days of the early Greeks, a major factor that influenced Bloom's work in developing current versions of mastery learning was a 1963 article by Harvard University professor John B. Carroll entitled, "A Model for School Learning." In this article, Carroll challenged long-held notions about student *aptitude*. He pointed out that student aptitude had traditionally been viewed as the *level* to which a child could learn a particular subject. Children with high aptitude would be able to learn the complexities of that subject, while children with low aptitude would be able to learn only the most basic elements. When aptitude is viewed in this way, children are seen as either good learners (high aptitude) or poor learners (low aptitude) with regard to a subject.

Carroll argued, however, that student aptitude more accurately reflects an index of *learning rate*. That is, all children have the potential to learn quite well but differ in terms of the time they require to do so. Some children are able to learn a subject very quickly while others take much longer. When aptitude is viewed as an index of learning rate, children are seen not simply as good and poor learners, but rather as fast and slow learners.

Carroll proposed a model for school learning based upon this alternative view of aptitude. He believed that if each child was allowed the time needed to learn a subject to some criterion level, and if the child spent that time appropriately, then the child would probably attain the specified level of achievement. But if enough time were not allowed or if the child did not spend the time required, then the child would learn much less. Thus the degree of learning attained by a child can be expressed by the following equation:

$$\text{Degree of learning} = f\left(\frac{\text{time spent}}{\text{time needed}}\right)$$

That is, the degree of learning is a function of the time a child actually spends on learning, relative to the time he or she needs to spend. If the time spent were equal to time needed, the learning would be complete and the equation would equal 1. However, if the time spent were less than the time needed, the learning would be incomplete by that proportion.

Carroll further identified the factors that he believed influenced the time spent and the time needed. He believed that both of these elements were affected by characteristics of the learner and by characteristics of the instruction. Specifically, he believed that the time spent was determined by a learner's *perseverance* and the *opportunity to learn*. Perseverance is simply the amount of time a child is willing to spend actively engaged in learning. Opportunity to learn is the classroom time allotted to the learning. In other words, time spent is determined by the child's persistence at a learning task and the amount of learning time provided. The time needed, on the other hand, Carroll believed was determined by the child's *learning rate* for that subject, the *quality of the instruction*, and the child's *ability to understand the instruction*. Thus:

$$\text{Degree of learning} = f\left(\begin{array}{l} \text{* perseverance} \\ \text{* opportunity to learn} \end{array} \Big/ \begin{array}{l} \text{* learning rate} \\ \text{* quality of instruction} \\ \text{* ability to understand the instruction} \end{array}\right)$$

Again, a child's learning rate is a measure of the time required by the child to learn the concepts or material under ideal instructional conditions. If the quality of the instruction were very high,

then the child would readily understand it and would probably need little time to learn. However, if the quality of the instruction were not as high, then the child would have greater difficulty understanding, and would require much more time in order to learn. In other words, the quality of the instruction and the child's ability to understand the instruction interact to determine how much time is needed for the child to learn the concepts or material.

Carroll's article was a significant contribution to learning theory and had profound influence on Bloom. It set forth new guidelines for research into the concept of aptitude and identified the specific factors that influence learning in school settings. His ideas about learning rate also prompted the development of a host of new "individualized instruction" programs that allowed students to progress through a series of learning units at their own, self-determined pace. Two of the most popular of these "continuous progress" programs were Individually Prescribed Instruction (IPI), developed at the University of Pittsburgh (Glaser, 1966; Scanlon, 1966), and Individually Guided Education (IGE), developed at the University of Wisconsin (Klausmeier, 1971; Klausmeier et al, 1968). Carroll himself, however, did not address the problem of how to provide sufficient time or how to improve instructional quality. These issues were left unresolved.

The Development of Mastery Learning

Impressed by the optimism of Carroll's work, Bloom extended Carroll's theoretical premises, developing his own theory and model of school learning. He recognized that while students vary widely in their learning rates, virtually all learn well when provided with the necessary time and appropriate learning conditions. If teachers could provide these more

appropriate conditions, Bloom believed that nearly all students could reach a high level of achievement and, hence, differences in their levels of achievement would vanish.

In *Human Characteristics and School Learning*, Bloom (1976) outlined the basic tenets of his theory. He believed that the history of any learner is defined in terms of cognitive entry behaviors (CEB) and affective entry characteristics (AEC). These two aspects of the learner's history then interact with four elements that determine the quality of instruction (QI): cues, participation, reinforcement, and feedback/correctives.

In considering the interaction of these elements, Bloom theorized that differences in students' cognitive entry behaviors account for 50% of the variation in school achievement whereas differences in affective entry characteristics account for 25%. Because these learner traits are not independent, however, Bloom suggested that in combination they could be expected to account for approximately 65% of the variation in school achievement. When quality of instruction is added, he believed the combination of cognitive entry behaviors, affective entry characteristics, and quality of instruction could be expected to account for more than 80% (p. 174) and as much as 90% (p. 169) of the variation in school achievement.

To determine how the four elements of quality of instruction might be optimized, Bloom first considered how teaching and learning take place in typical group-based classroom settings. He observed that most teachers begin by dividing the material that they want students to learn into smaller learning units. These units are usually sequentially ordered and often correspond to the chapters in the textbook used in teaching. Following instruction on the unit, teachers administer a test to determine how well students have learned the unit material. Based on the test results, students are sorted, ranked, and assigned grades. The test signifies the end of the unit to

students and the end of the time they need to spend working on the unit material. It also represents their one and only chance to demonstrate what they have learned.

When teaching and learning proceed in this manner, Bloom found that only a small number of students (about 20%) learns well the concepts and material from the unit. Under these conditions, the distribution of achievement at the end of the instructional sequence looks much like a normal bell-shaped curve.

Seeking a strategy that would produce better results, Bloom drew upon two sources of information. He first considered the ideal teaching and learning situation in which an excellent tutor is paired with an individual student. In other words, Bloom tried to determine what critical elements in one-to-one tutoring might be transferred to group-based instructional settings. Second, he reviewed descriptions of the learning strategies used by academically successful students. Here Bloom sought to identify the activities of high achieving students in group-based learning environments that distinguish them from their less successful counterparts.

Bloom saw organizing the concepts and material to be learned into small learning units, and checking on students' learning at the end of each unit, as useful instructional techniques. He believed, however, that the unit tests most teachers used did little more than show for whom the initial instruction was or was not appropriate. On the other hand, if these checks on learning were accompanied by a *feedback and corrective* procedure, they could serve as valuable learning tools. That is, instead of marking the end of the unit, Bloom recommended these tests be used to *diagnose* individual learning difficulties (feedback) and to *prescribe* specific remediation procedures (correctives).

This feedback and corrective procedure is precisely what takes place when a student works with an excellent tutor. If the student makes an mistake, the tutor points out the error

(feedback), and then follows up with further explanation and clarification (corrective). Similarly, academically successful students typically follow up the mistakes they make on quizzes and tests, seeking further information and greater understanding so that their errors are not repeated.

With this in mind, Bloom outlined an instructional strategy to make use of this feedback and corrective procedure. He labeled the strategy "Learning For Mastery" (Bloom, 1968), and later shortened it to simply "Mastery Learning." By this strategy, the important concepts students are to learn are first organized into instructional units, each taking about a week or two of instructional time. Following initial instruction on the unit concepts, a quiz or assessment is administered. Instead of signifying the end of the unit, however, this assessment is used primarily to give students information, or feedback, on their learning. To emphasize this new purpose Bloom suggested calling it a *formative assessment*, meaning "to inform or provide information." A formative assessment identifies for students precisely what they have learned well to that point, and what they need to learn better.

Included with the formative assessment are explicit suggestions to students on what they should do to correct their learning difficulties. These suggested corrective activities are specific to each item or set of prompts within the assessment so that students can work on those particular concepts they have not yet mastered. In other words, the correctives are "individualized." They might point out additional sources of information on a particular concept, such as the page numbers in the course textbook or workbook where the concept is discussed. They might identify alternative learning resources such as different textbooks, alternative materials, or computerized instructional lessons. Or they might simply suggest sources of additional practice, such as study guides, independent or guided practice exercises, or collaborative group activities.

With the feedback and corrective information gained from a formative assessment, each student has a detailed prescription of what more needs to be done to master the concepts or desired learning outcomes from the unit.

When students complete their corrective activities, usually after a class period or two, they are administered a second, parallel formative assessment. This second assessment serves two important purposes. First, it verifies whether or not the correctives were successful in helping students remedy their individual learning problems. Second and more importantly, it offers students a second chance at success and, hence, serves as a powerful motivation device.

Bloom believed that by providing students with these more favorable learning conditions, nearly all could learn excellently and truly master the subject (Bloom, 1976). As a result, the distribution of achievement among students would be highly skewed, with most students reaching very high levels of achievement. Note that the grading standards have not changed. Although the same level of achievement is used to assign grades, about 80% of the students reach the same high level of achievement under mastery learning conditions that only about 20% do under more traditional approaches to instruction.

The Essential Elements of Mastery Learning

Since Bloom first outlined his ideas, a great deal has been written about the theory of mastery learning and its accompanying instructional strategies (e.g., Block, 1971, 1974; Block & Anderson, 1975). Still, programs labeled "mastery learning" are known to vary greatly from setting to setting. As a result, educators interested in applying mastery learning have found it difficult to get a concise description of the essential elements of the process and the specific changes required for implementation.

In recent years two elements have been described as essential to mastery learning (Guskey, 1997a). Although the appearance of these elements may vary, they serve a very specific *purpose* in a mastery learning classroom and clearly differentiate mastery learning from other instructional strategies. These two essential elements are (1) *the feedback, corrective, and enrichment process*; and (2) *congruence among instructional components* or *alignment*.

Feedback, Correctives, and Enrichment

To use mastery learning a teacher *must* offer students regular and specific information on their learning progress. Furthermore, that information or *feedback* must be both diagnostic and prescriptive. That is, it should: (a) reinforce precisely what was important to learn in each unit of instruction, (b) identify what was learned well, and (c) describe what students need to spend more time learning. Effective feedback is also appropriate for students' level of learning.

But feedback alone will not help students greatly improve their learning. Significant improvement requires that the feedback be paired with specific corrective activities that offer students guidance and direction on how they can remedy their learning problems. It also requires that these activities be qualitatively different from the initial instruction. Simply having students go back and repeat a process that has already proven unsuccessful is unlikely to yield any better results. Therefore, correctives must offer an instructional alternative. They must present the material differently and involve students differently than did the initial teaching. They should incorporate different learning styles or learning modalities. Correctives also should be effective in improving performance. A new or alternative approach that does not help students overcome their learning difficulties is inappropriate as a corrective and should be avoided.

In most group-based applications of mastery learning, correctives are accompanied by enrichment or extension activities for students who master the unit concepts from the initial teaching. Enrichment activities provide these students with exciting opportunities to broaden and expand their learning. The best enrichments are both rewarding and challenging. Although they are usually related to the subject area, enrichments need not be tied directly to the content of a particular unit. They offer an excellent means of involving students in challenging, higher level activities like those typically designed for the gifted and talented.

This feedback, corrective, and enrichment process can be implemented in a variety of ways. Many mastery learning teachers use short, paper-and-pencil quizzes as formative assessments to give students feedback on their learning progress. But a formative can be any device used to gain evidence on students' learning progress. Thus, essays, compositions, projects, reports, performance tasks, skill demonstrations, and oral presentations can all serve as formative assessments.

Following a formative assessment, some teachers divide the class into separate corrective and enrichment groups. While the teacher directs the activities of students involved in correctives, the others work on self-selected, independent enrichment activities that provide opportunities for these students to extend and broaden their learning. Other teachers team with colleagues so that while one teacher oversees corrective activities the other monitors enrichments. Still other teachers use cooperative learning activities in which students work together in teams to ensure all reach the mastery level. If all attain mastery on the second formative assessment, the entire team receives special awards or credit.

Feedback, corrective, and enrichment procedures are crucial to the mastery learning process, for it is through these procedures that mastery learning "individualizes" instruction. In

every unit taught, students who need extended time and opportunity to remedy learning problems are offered these through correctives. Those students who learn quickly and for whom the initial instruction was highly appropriate are provided with opportunities to extend their learning through enrichment. As a result, all students are provided with favorable learning conditions and more appropriate, higher quality instruction.

Congruence Among Instructional Components

While feedback, correctives, and enrichment are extremely important, they alone do not constitute mastery learning. To be truly effective, they must be combined with the second essential element of mastery learning: *congruence among instructional components*.

The teaching and learning process is generally perceived to have three major components. To begin we must have some idea about what we want students to learn and be able to do; that is, the learning goals or outcomes. This is followed by instruction that, hopefully, results in competent learners – students who have learned well and whose competence can be assessed through some form of evaluation. Mastery learning adds a feedback and corrective component that allows teachers to determine for whom the initial instruction was appropriate and for whom learning alternatives are required.

Although essentially neutral with regard to what is taught, how it is taught, and how resultant is evaluated, mastery learning does demand there be consistency and alignment among these instructional components. For example, if students are expected to learn higher level skills such as those involved in application or analysis, mastery learning stipulates that instructional activities be planned to give students opportunities to engage actively in those skills. It also requires that students be given specific feedback on their learning of those skills, coupled with

directions on how to correct any learning errors. Finally, procedures for evaluating students' learning should reflect those skills as well.

Ensuring congruence among instructional components requires teachers to make some crucial decisions. They must decide, for example, what concepts or skills are most important for students to learn and most central to students' understanding of the subject. But in essence, teachers at all levels make these decisions daily. Every time a test is administered, a paper is graded, or any evaluation made, teachers communicate to their students what they consider to be most important. Using mastery learning simply compels teachers to make these decisions more thoughtfully and more intentionally than is typical.

Misinterpretations of Mastery Learning

Some early attempts to implement mastery learning were based on narrow and inaccurate interpretations of Bloom's ideas. These programs focused on low level cognitive skills, attempted to break learning down into small segments, and insisted students "master" each segment before being permitted to move on. Teachers were regarded in these programs as little more than managers of materials and record-keepers of student progress. Unfortunately, similar misinterpretations of mastery learning continue today.

Nowhere in Bloom's writing can the suggestion of such narrowness and rigidity be found. Bloom considered thoughtful and reflective teachers vital to the successful implementation of mastery learning and stressed flexibility in his earliest descriptions of the process:

> There are many alternative strategies for mastery learning. Each strategy must find some way of dealing with individual differences in learners through some means of

relating the instruction to the needs and characteristics of the learners. ... The nongraded school ... is one attempt to provide an organizational structure that permits and encourages mastery learning. (Bloom, 1968, pp. 7-8).

Bloom also emphasized the need to focus instruction in mastery learning classrooms on higher level learning outcomes, not simply basic skills. He noted:

> I find great emphasis on problem solving, applications of principles, analytical skills, and creativity. Such higher mental processes are emphasized because this type of learning enables the individual to relate his or her learning to the many problems he or she encounters in day-to-day living. These abilities are stressed because they are retained and utilized long after the individual has forgotten the detailed specifics of the subject matter taught in the schools. These abilities are regarded as one set of essential characteristics needed to continue learning and to cope with a rapidly changing world. (Bloom, 1978, p. 578).

Recent research studies show, in fact, that mastery learning is highly effective when instruction focuses on high level outcomes such as problem solving, drawing inferences, deductive reasoning, and creative expression (Guskey, 1997a).

Research Results and Implications

Implementing mastery learning does not require drastic alterations in most teachers' instructional procedures. Rather, it builds on the practices teachers have developed and refined over the years. Most excellent teachers are undoubtedly using some form of mastery learning already. Others are likely to find the process blends well with their present teaching strategies.

This makes mastery learning particularly attractive to teachers, especially considering the difficulties associated with new approaches that require major changes in teaching.

Despite the relatively modest changes required to implement mastery learning, extensive research evidence shows the use of its essential elements can have very positive effects on student learning (Guskey & Pigott, 1988; Kulik, Kulik, & Bangert-Drowns, 1990a). Providing feedback, correctives, and enrichments; and ensuring congruence among instructional components; takes relatively little time or effort, especially if tasks are shared among teaching colleagues. Still, evidence gathered in the United States, Asia, Australia, Europe, and South America shows the careful and systematic use of these elements can lead to significant improvements in student learning.

Equally important, the positive effects of mastery learning are not restricted only to measures of student achievement. The process also has been shown to yield improvements in students' school attendance rates, their involvement in class lessons, and their attitudes toward learning (Guskey & Pigott, 1988). This multidimensional impact has been referred to as the "multiplier effect" of mastery learning, and makes it one of today's most cost-effective means of educational improvement.

It should be noted that one review of the research on mastery learning, contrary to all previous reviews, indicated that the process had essentially no effect on student achievement (Slavin, 1987). This finding surprised not only scholars familiar with the vast research literature on mastery learning showing it to yield very positive results, but also large numbers of practitioners who had experienced its positive impact first hand. A close inspection of this review shows, however, that it was conducted using techniques of questionable validity, employed capricious selection criteria (Kulik, Kulik, & Bangert-Drowns, 1990b), reported

results in a biased manner, and drew conclusions not substantiated by the evidence presented (Guskey, 1987). Most importantly, two much more extensive and methodologically sound reviews published since (Guskey & Pigott, 1988; Kulik, Kulik, & Bangert-Drowns, 1990a) have verified mastery learning's consistently positive impact on a broad range of student learning outcomes and, in one case (i.e., Kulik, Kulik, & Bangert-Drowns, 1990b), showed clearly the distorted nature of this earlier report.

Conclusion

Researchers today generally recognize the value of the essential elements of mastery learning and the importance of these elements in effective teaching at any level. As a result, fewer studies are being conducted on the mastery learning process, per se. Instead, researchers are looking for ways to enhance results further, adding to the mastery learning process additional elements that positively contribute to student learning in hopes of attaining even more impressive gains (Bloom, 1984). Recent work on the integration of mastery learning with other innovative strategies appears especially promising (Guskey, 1997b).

Mastery learning is not an educational panacea and will not solve all the complex problems facing educators today. It also does not reach the limits of what is possible in terms of the potential for teaching and learning. Exciting work is continuing on new ideas designed to attain results far more positive than those typically derived through the use of mastery learning (Bloom, 1984, 1988). Careful attention to the essential elements of mastery learning, however, will allow educators at all levels to make great strides toward the goal of all children learning excellently.

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